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MODERN SANITATION

BY ALVAH H. DOTY, M.D.

HISTORY presents little or no authentic information regarding the means employed in very early times for the protection of the public health, and it is doubtless true that the measures enforced in dealing with outbreaks of infectious disease and sanitary conditions, depended chiefly upon the various theories of those in charge of this branch of the public service. The term plague constantly occurs in connection with the literature of these outbreaks, although cholera and typhus fever, particularly the former, were unquestionably frequently involved as well as plague.

The loss of life reported to have been caused by these outbreaks seems almost incredible, although it is verified by reliable statistics. During the fourteenth century plague brought from the East invaded western Europe, and under the name of the "Black Death" swept away within a few years one-quarter of the population of that section of the world, probably about twenty-five million inhabitants.

Even as late as the last century typhus fever appeared in Ireland, and the rapidity of its extension and destruction of life almost equaled the outbreaks of earlier times. It is a significant fact that this outbreak occurred during the well-known Irish famine, which was associated with great destitution, overcrowding, and filth, and did not disappear until the return of a plentiful harvest.

In the past the occurrence of these outbreaks was commonly regarded as a visitation of Providence which should not be interfered with. Even now this belief exists to a large extent in the far East, where outbreaks of cholera and plague frequently occur and where modern methods of sanitation are apt to be looked upon with displeasure, and the assassination

of sanitary officers who are striving to enforce proper health regulation is of common occurrence.

A belief still exists throughout the world that the East is the permanent home of cholera and plague and for some reason they cannot be exterminated. Nothing is further from the truth. The various religious beliefs, ignorance, and, more particularly, political conditions, have made it impossible, or rather impracticable, to carry out the necessary means to destroy these infected centers.

To-day modern sanitation justifies the statement that the deplorable conditions which have been referred to will never occur again where proper sanitary measures are in force. This does not imply that an outbreak of an infectious disease is promptly and easily dealt with or that its appearance in a community may not be associated with considerable concern, but it means that it is sure to be successfully controlled if proper sanitary methods are enforced.

It is of great interest to know by what means this exceedingly important change has been effected, the value of which cannot be overestimated.

During the centuries which have passed there have been many students and indefatigable workers along the lines of public health protection who have added largely to the general knowledge of this subject. For instance, during the fourteenth century quarantine was first instituted. This occurred in Venice. The term quarantine is of Italian derivation and literally means a detention of forty days. No satisfactory information exists as to why this period should have been selected for the detention of vessels arriving from presumably infected ports; and although the earlier quarantine regulations were for various reasons defective, still it was an advanced step in public sanitation and particularly emphasized the value of preventive measures.

A further illustration of this may be cited; this is in connection with the work of Cardinal Gastaldi which occurred during the outbreak of plague in Rome in the seventeenth century. He not only assumed general management of this emergency, but looked after the details as well. His intense interest in the subject, his study of the course of the disease and the means of combating it, led him to insist upon cleanliness and so far as possible the careful isolation of the cases. To-day these two factors are regarded as among the most potent in preventing the extension of infection. As a re-

sult of the Cardinal's effort, there were but fourteen thousand deaths in Rome, while at the same period three hundred thousand deaths occurred in Naples. While it cannot properly be said that this remarkable difference in mortality was due wholly to the precaution taken by Cardinal Gastaldi, it is entirely fair and logical to assume that the methods he employed were the chief causes of the more favorable result in Rome.

Although the effectiveness of sanitary methods continuously increased, it was not until about 1880 that public sanitation was placed on a scientific basis and a new era in the protection of the public health began. The public know but little of this important event and how far-reaching and successful it has been in defining the means to be employed to secure this end. It may properly be said to mark one of the great discoveries in the history of the world, for at that time were made known the researches of Pasteur and Koch respectively, a French and a German bacteriologist who had been working independently of each other. The evidence they presented as to the germ origin of infectious diseases was absolute and conclusive. The announcement of their discoveries gave instant and enormous stimulus to further bacteriological investigation, and in comparatively quick succession followed the identification of the specific organism or germ of many of the infectious diseases. The list now includes tuberculosis, cholera, plague, typhoid fever, diphtheria, and others. It must be obvious to all that the value of this knowledge cannot be overestimated. It means we now know the enemy we deal with in the prevention of infectious diseases, its character and the means by which it can be attacked and destroyed, while before this discovery ignorance prevailed on this special subject.

Exhaustive investigation as to the means by which infectious germs are transmitted from one person to another has also been carried out. This has been rewarded by the most satisfactory results, and, among other things, has presented indisputable evidence of the falseness of some of the former theories relating to this subject. Some of these theories which were popular in the past have in modern times fallen by their own weight; others have continued to prevail, and at least one of them is still popular, although, curiously enough, there is but little scientific evidence to sustain it. From the earliest times this theory has dominated

all health regulations the object of which has been to prevent the extension of infectious diseases. I refer to the belief that clothing, baggage, money, cargoes of vessels, etc., are *ordinary* or *common* means of infection. This is now known as the Fomites theory. Proof that it was generally accepted as early as the fourteenth century is shown by the fact that while vessels at that period were held in quarantine, certain portions of their cargo, clothing, etc., were placed on deck in order that they might be purified by the sun and air. Those who still accept this theory believe that various articles, particularly textile fabrics, are able to transmit the organisms of at least some of the infectious diseases in their active state from one person to another. There is probably no theory ever advanced which has been so generally accepted as this one, although it has militated against the successful treatment of outbreaks of infectious disease, for it has encouraged carelessness in determining the origin of these outbreaks, whereas the most careful and exhaustive investigation should be made to secure this information. Besides, this theory has frequently been carried to a hysterical degree even in public health work. In the past vessels have been sunk by official order simply to prevent what was believed to be danger from the transmission of disease through the medium of the cargo. Even within a few years iron rails were disinfected to prevent the transmission of yellow fever, and it has been seriously stated that a coat worn by a well person who had been in the vicinity where yellow fever existed was responsible for an outbreak of this disease. How vulnerable this theory is in the face of scientific investigation may be shown by the results which have from time to time been presented; for instance, it is now known that yellow fever is not only never transmitted by clothing, baggage, etc., but only by a variety of the mosquito known as the "*Stegomyia*." The credit of this important discovery belongs to a commission appointed by the President of the United States in 1900, and sent to Cuba for the purpose of investigating this subject.

Later researches have also proved that insects and vermin play a very important part as agents of infection in diseases formerly attributed to infected articles such as clothing, etc. Rags and money are also generally believed to be active factors in the transmission of infectious disease; scientific evidence does not confirm this. The writ-

er's investigation of rags as a medium of infection which was carried out both in this country and in Egypt furnishes not the slightest evidence that they transmit disease. Egypt has supplied this country with an immense amount of rags which have been used for the manufacture of paper. They consist largely of the worn-out apparel of the natives and are collected throughout lower Egypt, from whence they are forwarded to Alexandria. Here they are picked over or sorted out principally by women and children whom I found daily in close and prolonged contact with this material; nevertheless, the carefully prepared statistics of the British sanitary officers who were in charge showed not the slightest evidence that infectious diseases were transmitted through this source. Personal observations in this country relative to this material were productive of exactly the same result. During the past ten or fifteen years I have also carefully investigated the subject of money as a means of infection with negative results. The most effective and impressive test in regard to this particular investigation was the evidence secured at the Treasury Department at Washington. Here an enormous amount of filthy and worn-out paper money is being constantly handled and rehandled by many employees prior to its destruction. Surely if paper money was a medium of infection it would be apparent under these extreme conditions. Still no evidence was secured that through this source infectious diseases were transmitted. Neither is there evidence that employees of banks who are constantly handling money contract disease in this way. Statements are not infrequently made that employees in paper manufactories or in banks become ill with infectious diseases. This is promptly accepted as evidence that rags or money constitute a common means of infection. This reasoning is neither logical nor scientific, because these persons are subject to the same outside exposure that others are, and therefore may in the same way contract infectious diseases. Proper evidence that these articles are media of infection would be the more or less constant demonstration that those whose business brings them in close contact with rags and money are more frequently infected than persons who follow other vocations; there is no such evidence. These results are in harmony with the views of other investigators.

Malaria, which was formerly supposed to be caused by poisonous emanations from swamps, particularly during the

night-time, is now known to be, like yellow fever, transmitted only by a certain variety of the mosquito, and that the reason why swamp land is actually associated with malaria is that it is a favorite breeding-place for the malarial mosquito, known as the "Anopheles," which is particularly active at night.

If the former theories of the transmission of infectious diseases are wrong, the question naturally is asked, what are the actual means by which these diseases are transmitted from one person to another? Bacteriological research, investigation in other directions, and the experience of practical sanitarians have thrown new light upon the subject and have furnished scientific proof as to the real media of infection. We now know that persons and not things transmit disease—that is, by actual contact; also that disease is transmitted by the discharges in their active state of those who have infectious diseases, and also by insects and vermin. No one who is practically familiar with this subject doubts that in rare instances articles of clothing or other material may transmit infection. While this possibility should receive respectful consideration it must be understood that it is not the rare or uncommon media of infection that must engage our special attention, but rather the usual or common means by which infectious diseases are transmitted; otherwise, successful results cannot be obtained. Besides, modern sanitation cannot guarantee complete safety, and efforts which are made to secure this result are theoretical and defeat the end in view.

Another extremely serious factor in the transmission of diseases, and one which has been more thoroughly recognized in recent years, is the frequent presence of mild or irregular cases, quite capable of communicating infection, but so mild as to easily escape detection. Furthermore, we have very recently learned that persons known as "carriers" may transmit disease without presenting any evidence of it themselves. This has been clearly demonstrated particularly in cholera and typhoid fever, and there is no reason why it may not occur in connection with other diseases, and there is no doubt that further investigation will prove that carriers are commonly responsible for outbreaks of infectious disease the origin of which has been attributed to other causes.

As an illustration: Two years ago in an adjoining town the origin of a formidable outbreak of typhoid fever remained in doubt for some time, until it was found that an employee in

one of the local dairies whose work consisted in washing the milk-cans was proved by bacteriological examination to be a pronounced typhoid carrier, and, although apparently in good health, he had undoubtedly infected the milk-can through the medium of his hands. He was removed from the dairy, placed under observation, and the outbreak of typhoid subsided.

With the facts we now possess regarding the true means by which infectious diseases are transmitted, every effort should be made to use this knowledge in the better protection of the public health. It not only enables a health official to deal more successfully with an outbreak of infectious disease, but secures more intelligent co-operation from the public in carrying out needed sanitary measures. The public are harassed with the feeling that they are constantly exposed to danger of infection through the clothing of those they may meet and in the handling of money, and many other ways. This has given rise to a general nervousness and fear which is entirely without justification or foundation. For instance, within the past few years an association has been formed having its headquarters in a western city for the specific purpose of urging Congress to supply new money or to at least disinfect the old on the ground that it transmits disease.

Probably no more farcical thing could be suggested than the disinfection of money. In the first place, no other agent but steam could be used for this purpose and even this would not penetrate large bulks of paper money; again, who would perform the disinfection, and where and when would it be done? There is no doubt as to the filthy and unsightly condition of our paper money and the advantage of frequently replacing old bills with new ones largely as an esthetic proposition, but it is needlessly disturbing to suggest the importance of this on the ground that money constitutes an ordinary means of infection, for it does not. It was but recently stated in the daily press that a prominent citizen always carries with him a celluloid loop which he uses instead of the ordinary car straps to prevent infection. He was probably not aware that the bacteria or germs found on car straps, railways, money, clothing, hands, etc., are, as a rule, harmless, some of which may even be necessary to life, and that the possible presence of the specific germs of infectious diseases in a condition to transmit infection need cause no alarm.

The public should know that if they happen in a conveyance, assemblage, or elsewhere, and are in close proximity to some infectious disease, they need have no fear that they will transmit it to their family or others through the medium of their clothing. Nor need they fear that they will contract disease from the clothing of others they may meet or through the medium of the money they may handle.

The dread of this has been responsible for many unnecessary and unjust regulations. Well persons in a family where infectious disease exists are either kept in the house under municipal regulation or voluntarily remain at home for fear they may transmit disease to others. This frequently seriously affects those whose income is necessary for the support of the family. Except in some special instance, and under direction of health officials, it is far better that these persons should be out of the house. What modern sanitation requires is that the patient shall be carefully isolated or quarantined, that there shall be no communication whatever with other members of the family except those who are in actual charge of the patient, and that the well members shall be examined carefully each day to ascertain if they have contracted the disease. It is only when this occurs that they are a menace to outsiders and not through the medium of their clothing.

One of the principles of modern sanitation is to prevent disease with as little annoyance as possible to the public, and it is for this reason that where large numbers of persons are together, as in factories, etc., there should be a constant supervision over them to detect the early appearance of an outbreak of infectious disease; in this way fewer persons are involved, the loss of life is diminished, and the well-being of these people protected.

The rejection of the Fomites theory not only does not weaken the defense against infectious disease, but greatly strengthens it, for it turns our attention to the real means by which infection occurs. It calls for an immediate and exhaustive inspection in vicinities where infectious disease appears in order to promptly ascertain its origin from earlier cases instead of assuming that in some way it may have been caused by infected clothing. The most careful attention is demanded in connection with the destruction of the discharges of those who are infected, also cleanliness, fresh air, etc.; it insures far more effective co-operation on the part of

the public if they are educated as to the true means of infection. In many other ways it furthers the ends of modern sanitation, and aids in the *prevention* of disease.

Heretofore the public have been apathetic and have taken but little interest in public health work, but it is largely because the people have not been properly informed regarding public sanitation in general and particularly the means by which infectious diseases are transmitted. It is the hope of sanitarians that many of the infectious diseases may be absolutely obliterated. With the co-operation of the public this may be accomplished; without it, it is impossible. Therefore, in the future, the public must be depended upon to do its share in bringing about these important results. Each home should constitute a sanitary unit. Great corporations which have in their charge large bodies of people should have some form of organization within themselves for the improvement of sanitary methods to insure cleanliness, fresh air, pure water, proper sanitary arrangements, etc. Means should also be employed to insure the early detection of infection among their number by careful observation and isolation of those who have been exposed. As has been already stated, nothing is more important in preventing the extension of disease. Co-operation of this kind is not only remarkably simple, but is a saving of life and health, and indirectly a matter of economy as well. Employees thus taught carry the knowledge to their homes and instinctively bring about better conditions.

Swamp lands and receptacles containing water where mosquitoes breed should be drained, filled in, or promptly covered in order that the propagation of this insect may be prevented and its extermination accomplished. It has already been shown that the mosquito has been responsible for the propagation of malaria and yellow fever, two diseases which at various times have almost decimated the population of various parts of the world; evidence is still accumulating that insects are the media of infection in other diseases.

In conclusion it may be said that co-operation on the part of the public in carrying out the dictates of modern sanitation by organized methods is not only sure to extend life and to improve health, but sooner or later will lead to the extermination of at least some of the present actively destructive diseases.

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